

CLAIMS

What is claimed is:

1 1. A spread-spectrum receiver comprising:
2 a high-rate path to receive multi-rate channels; and
3 a low-rate path to receive fixed-rate channels.

1 2. The receiver of claim 1 wherein the receiver is a wideband code
2 division multiple access (WCDMA) receiver and the high-rate path despreads
3 spread-spectrum multi-rate physical channels having a variable spreading factor
4 and the low-rate path despreads fixed-rate spread-spectrum physical channels
5 having a fixed spreading factor.

1 3. The receiver of claim 1 wherein the high-rate path comprises at least
2 one high-rate rake finger to despread spread-spectrum signals comprising the
3 multi-rate channels, each multi-rate channel having a different spreading code
4 allowing for the substantially simultaneous reception of several multi-rate
5 channels.

1 4. The receiver of claim 3 wherein the at least one high-rate rake finger
2 comprises:
3 a set of correlators, each correlator to despread one multi-rate channel of
4 the several received multi-rate channels with a corresponding spreading code;
5 a framer to separate control symbols and data symbols for each of the
6 despread multi-rate channels; and
7 a buffer for each multi-rate channel to store the control and data symbols
8 for the corresponding multi-rate channel.

1 5. The receiver of claim 4 wherein the at least one high-rate rake finger
2 further comprises a code generator to generate the corresponding spreading codes
3 for despread each of the several multi-rate channels.

1 6. The receiver of claim 5 wherein the at least one high-rate rake finger
2 further comprises:

3 a pilot channel correlator to despread a pilot channel having a
4 predetermined spreading factor; and
5 a pilot channel buffer to store symbols from the despread pilot channel
6 received from the pilot channel correlator,
7 and wherein the code generator also generates a spreading code for
8 despreading by the pilot channel correlator.

1 7. The receiver of claim 1 wherein the multi-rate channels have a
2 spreading factor ranging approximately from 4 to 256, and the fixed-rate channels
3 has a spreading factor of approximately 256.

1 8. The receiver of claim 7 wherein the multi-rate channels have a bit-rate
2 ranging approximately from 30 – 960 kbps, and the fixed-rate channels have a bit-
3 rate of approximately 30 kbps.

1 9. The receiver of claim 3 wherein the high-rate path further comprises a
2 high-rate rake to read symbols from the at least one high-rate rake finger and to
3 multiply the symbols by a channel estimation.

1 10. The receiver of claim 9 wherein the high-rate rake is comprised of at
2 least one finger engine to multiply the symbols with the channel estimation, and a
3 combiner to combine multipath components of the multi-rate channels.

1 11. The receiver of claim 9 wherein the at least one high-rate rake finger is
2 one of a plurality of high-rate rake fingers, each high-rate rake finger to despread
3 a multipath component of each multi-rate channel, and

4 wherein the at least one finger engine is one of a plurality of finger
5 engines, each finger engine to multiply the channel estimation with the symbols
6 from a corresponding high-rate rake finger for each of the several multi-rate
7 channels, and

8 wherein the combiner coherently combines symbols from the multipath
9 components from the finger engines for the several multi-rate channels.

1 12. The receiver of claim 9 wherein the at least one high-rate rake finger
2 and the high-rate rake are implemented with hardware elements, and wherein the
3 low-rate path comprises:

4 at least one low-rate finger to despread a multipath component of spread-
5 spectrum signals comprising the fixed-rate channels; and

6 a digital signal processor (DSP) to generate a channel estimation and to
7 coherently combine symbols from the at least one low-rate finger with the channel
8 estimation.

1 13. The receiver of claim 12 wherein the DSP assigns the at least one
2 high-rate finger a multi-path component of the several multi-rate channels and the
3 at least one low-rate finger a multi-path component of the fixed-rate channels.

1 14. The receiver of claim 13 wherein the at least one high-rate rake finger
2 is one of a plurality of high-rate rake fingers, each high-rate rake finger to
3 despread a multipath component of each multi-rate channel, and wherein the DSP
4 performs frequency and time tracking to synchronize the high-rate fingers.

1 15. The receiver of claim 14 further comprising an interpolator to receive
2 baseband samples from an analog front end and raise a sampling rate of the
3 baseband samples to provide the baseband samples with an increased sampling
4 rate to the high-rate path and the low-rate path for use by the rake fingers.

1 16. The receiver of claim 2 wherein the high-rate and low-rate paths are
2 part of a low-level portion of the receiver which despreads and decodes the
3 physical channels, and wherein the receiver further comprises a high-level portion
4 to map the physical channels to transport channels.

1 17. A method for receiving spread-spectrum signals comprising:
2 despreading multi-rate channels in high-rate path; and
3 despreading fixed-rate channels in a low-rate path.

1 18. The method of claim 17 wherein at least one high-rate rake finger
2 despreads spread-spectrum signals comprising the multi-rate channels, wherein
3 each multi-rate channel has a different spreading code allowing for the
4 substantially simultaneous reception of several multi-rate channels.

1 19. The method of claim 18 wherein the despreading the multi-rate
2 channels comprises:

3 despreading one multi-rate channel of the several received multi-rate
4 channels with a corresponding spreading code;
5 separating control symbols and data symbols for each of the despread
6 multi-rate channels; and
7 buffering the control and data symbols for each multi-rate channel.

1 20. The method of claim 19 further comprising:
2 generating the corresponding spreading codes for despreading each of the
3 several multi-rate channels; and
4 multiplying the data symbols with the channel estimation for each of a
5 plurality of multipath components; and
6 combining multipath components of the multi-rate channels.

1 21. The method of claim 17 wherein the multi-rate channels have a
2 spreading factor ranging approximately from 4 to 256, and the fixed-rate channels
3 has a spreading factor of approximately 256.

1 22. The method of claim 20 wherein despreading the multi-rate channels is
2 performed by at least one high-rate rake finger implemented with hardware
3 elements, and wherein despreading the fixed-rate channels is performed with at
4 least one low-rate finger to despread a multipath component of spread-spectrum
5 signals comprising the fixed-rate channels, and wherein a digital signal processor

6 (DSP) generates a channel estimation and coherently combines symbols from the
7 at least one low-rate finger with the channel estimation.

1 23. The method of claim 22 further comprising assigning, by the DSP, the
2 at least one high-rate finger a multi-path component of the several multi-rate
3 channels, and the at least one low-rate finger a multi-path component of the fixed-
4 rate channels.

1 24. A wideband code division multiple access (WCDMA) receiver to
2 despread multi-rate spread-spectrum physical channels having a variable
3 spreading factor and to despread fixed-rate spread-spectrum physical channels
4 having a fixed spreading factor, the receiver comprising a high-rate path to
5 receive the multi-rate channels and a low-rate path to receive the fixed-rate
6 channels, the high-rate path comprises:

7 a plurality of high-rate rake fingers to despread a multi-path component of
8 each multi-rate channel; and

9 a high-rate rake to read symbols from the high-rate rake fingers, to
10 multiply the symbols by a channel estimation, and combine the multi-path
11 components from each rake finger,

12 and the low-rate path comprises:

13 at least one low-rate finger to despread a multipath component of spread-
14 spectrum signals comprising the fixed-rate channels; and

15 a digital signal processor (DSP) to generate a channel estimation and to
16 coherently combine symbols from the at least one low-rate finger with the channel
17 estimation.

1 25. The receiver of claim 24 wherein the high-rate rake fingers comprise:
2 a set of correlators, each correlator to despread one multi-rate channel of
3 the several received multi-rate channels with a corresponding spreading code;
4 a framer to separate control symbols and data symbols for each of the
5 despread multi-rate channels;
6 a buffer for each multi-rate channel to store the control and data symbols
7 for the corresponding multi-rate channel; and

8 a code generator to generate the corresponding spreading codes for
9 despreading each of the several multi-rate channels.

1 26. The receiver of claim 25 wherein each multi-rate channel has a
2 different spreading code allowing for the substantially simultaneous reception of
3 several multi-rate channels, and wherein the multi-rate channels have a spreading
4 factor ranging approximately from 4 to 256, and the fixed-rate channels has a
5 spreading factor of approximately 256.